Poster #40

AI and Data Science Using NASA's Solar System Treks

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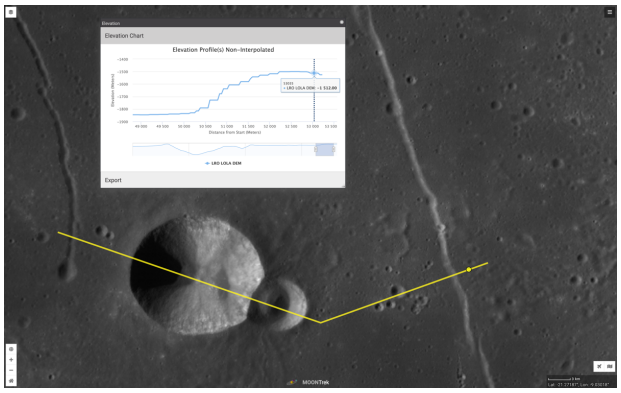
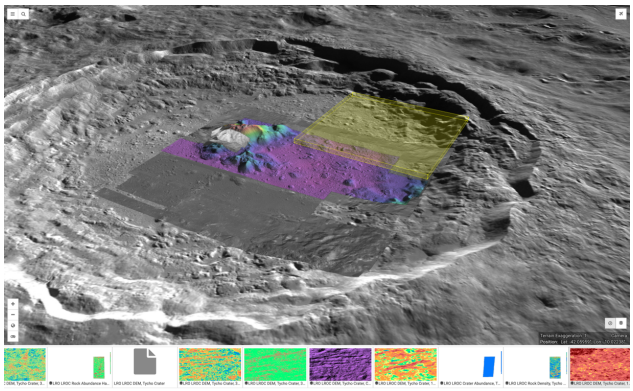
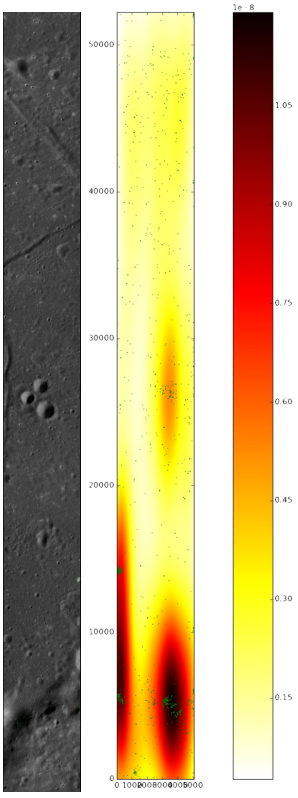
NASA's Solar System Treks program of lunar and planetary mapping and modeling produces a suite of interactive visualization and AI/data science analysis tools (https://trek.nasa.gov). These tools enable mission planners, planetary scientists, and engineers to access mapped data products derived from big data returned from a wide range of instruments aboard a variety of past and current missions, for a growing number of planetary bodies.

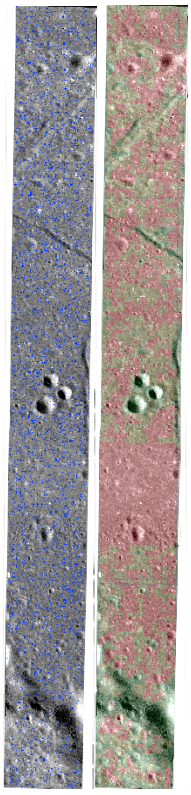


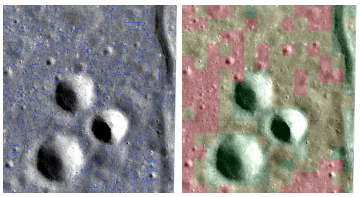


The portals provide easy-to-use tools for browsing, data layering and feature search, including detailed information on the source of each assembled data product. Interactive maps, include the ability to overlay a growing range of data sets. They allow users to easily find and access the geospatial products that are available. Data products can be viewed in 2D and 3D, in VR and can be easily integrated by stacking and blending together rendering optimal visualization. Data sets can be plotted and compared against each other. Standard gaming and 3D mouse controllers allow users to maneuver first-person visualizations of flying across planetary surfaces.

The portals provide a set of advanced analysis tools that employed AI and data science methods. The tools facilitate measurement and study of terrain including distance, height, and depth of surface features. They allow users to perform analyses such as lighting and local hazard assessments including slope, surface roughness and crater/boulder distribution, rockfall distribution, surface electrostatic potential, line of sight calculation and optimal traverse path determination. These tools facilitate a wide range of activities including the planning, design, development, test and operations associated with lunar sortie missions; robotic (and potentially crewed) operations on the surface; planning tasks in the areas of landing site evaluation and selection; design and placement of landers and other stationary assets; design of rovers and other mobile assets; developing terrain-relative navigation (TRN) capabilities; deorbit/impact site visualization; and assessment and planning of science traverses.

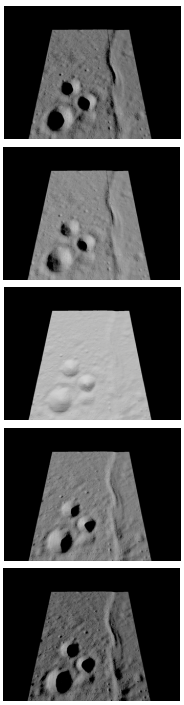




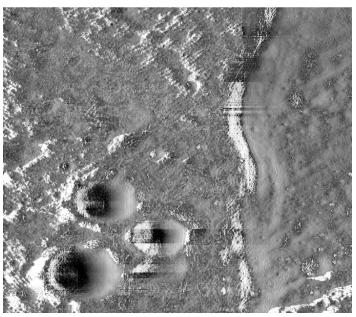


The images to the left and above are output from the crater detector and rock detector tools, respectively, with hazard maps to the right of the images on which the detection algorithms were run. These algorithms use neural networks and traditional image processing for detection and recognition.

The five images to the right are snippets from the lighting tool which takes a region of a Digital Elevation Model (DEM) and computes the amount of wattage for every pixel as a function of time with a ray tracing algorithm.



The image to the right is the result of calculating the potential static charge, or the static charge resulting from solar comic rays, per pixel over a given region of a Digital Elevation Model (DEM).



Nine portals are publicly available (https://trek.nasa.gov) to explore the Moon, Mars, Vesta, Ceres, Titan, Saturn's Icy Moons, Mercury, Bennu and Ryugu with more portals in development and planning stages. Contact trek@jpl.nasa.gov with any questions or concerns.

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